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16. Studies on Silicone Resins. (XI) On the Diamagnetic Properties

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The object of this investigation is to discuss the ionic properties of the siloxane bond in the silicone by a magnetic measurement.

By Quincke method the susceptibilities χ_g of hexamethyldisiloxane and methyl silicone oil are measured.

The measured results indicate diamagnetic properties as follows.

$$\chi_g \text{ of hexamethyldisiloxane} = -0.804 \times 10^{-6}$$

$$\chi_g \text{ of methyl silicone oil} = -0.730 \times 10^{-6}$$

On the other hand, there is so called Pascal's additive law on the diamagnetic properties of organic compounds as shown in the following equation:

$$\chi_M = \sum a \chi_A + \lambda \dots \dots \dots (1)$$

where χ_M is molecular susceptibility, a is the number of atoms in the molecule of susceptibility χ_A and λ is a constitutive constant depending on the nature of the linkage between the atoms.

The diamagnetic susceptibilities of H, C and O in organic compounds are already known experimentally. And the diamagnetic susceptibilities of Si, Si^{+2} can be calculated by the Slater-Angus method,

These experimental and calculated values of the susceptibilities of atoms and ions are put into formula (1), and the ionic properties of a siloxane bond may be discussed.

As the results, on two or three assumptions, ionic properties of a siloxane bond in hexamethyldisiloxane are seemed to be considerably few and its ion is considered as Si^{+1} . By Pauling it is said that the siloxane bond has the ionic character of 50%.

Then the degree of ionic character of a siloxane bond in methyl silicone oil, whose molecular weight measured from its viscosity is 69300, is calculated to be about 60%, and its ion is considered as Si^{+2} .